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A New Method of Producing and Detecting Sorghum Hybrids

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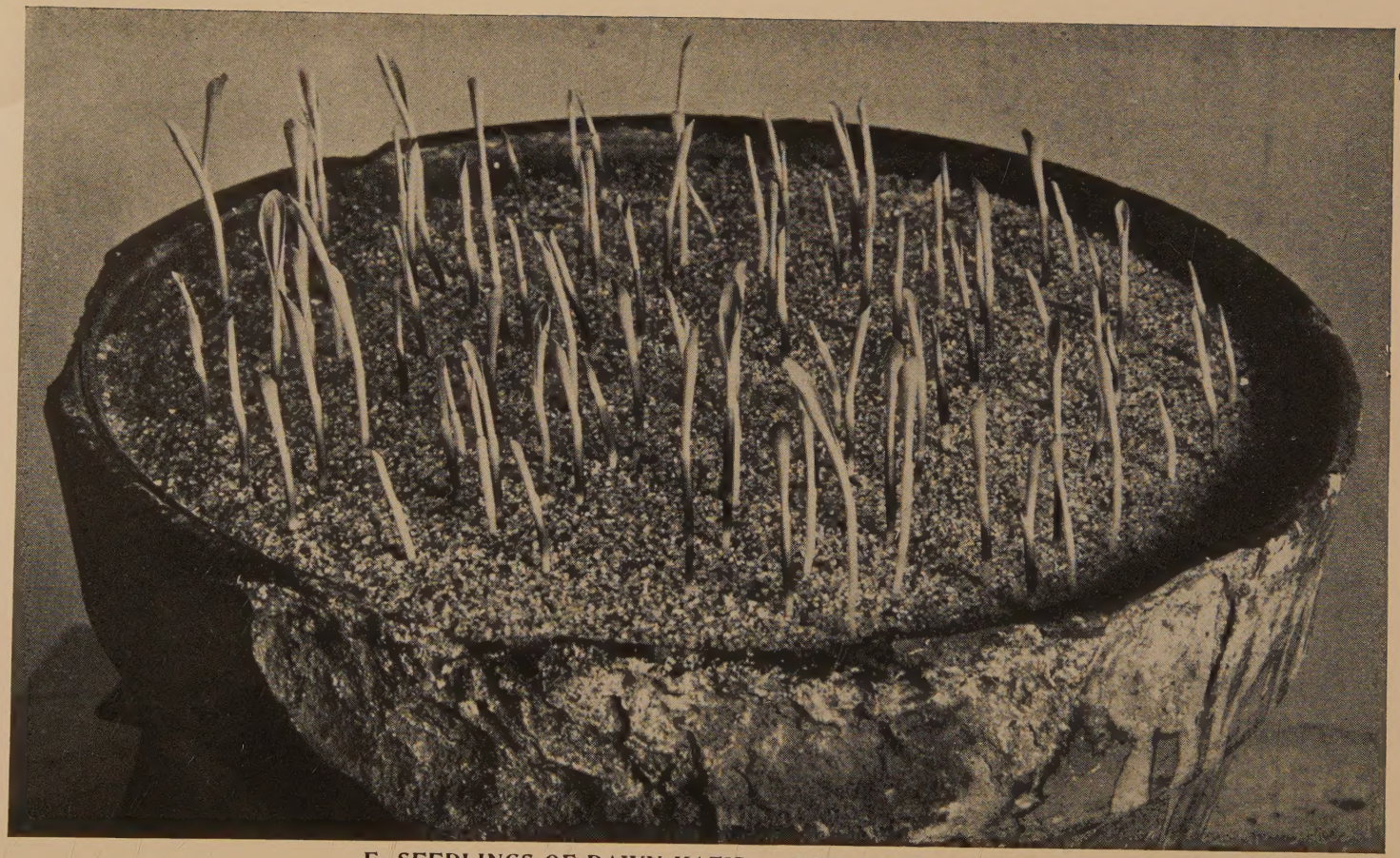

F_2 SEEDLINGS OF DAWN KAFIR × RED AMBER SORGO

Figure 24

When photographed the seedlings were nine days old and the red and green types can readily be recognized. The seedlings were removed and counted when they were two weeks old and 66 were red and 30 were green.

A NEW METHOD OF PRODUCING AND DETECTING SORGHUM HYBRIDS

GEORGE M. REED

*Brooklyn Botanical Garden**

FOR several years I have been engaged in the study of smut resistance in sorghums. These plants are attacked by ten different species of smut, seven of which seem to be local in their distribution and as yet have not been recorded for the United States. Three species—covered kernel smut, loose kernel smut and head smut—are world-wide in their distribution and are more or less common wherever sorghums are grown. The covered kernel smut is unquestionably the most common, wide-spread and destructive disease of this group of plants. The head smut is interesting because the same species is recorded as a parasite on corn or maize, being especially destructive to this crop in Australia. There is definite evidence, however, that the head smuts of maize and sorghum are distinct specialized races[10].

The sorghums include very diverse types of cultivated plants derived from various parts of the old world. In northern China and Manchuria the Kaoliangs are extensively cultivated; in India, Jowar ranks third among the cultivated crops; sorghums are very widely distributed in Africa and are a staple crop of a large proportion of the native population. Broom corn has been cultivated in Italy for at least three hundred years and today is an important agricultural product in Italy and Hungary.

The sorghums, possessing a special value on account of their drought resistance, have been introduced into the United States from different parts of the world and are grown for a variety of purposes. From the agronomic standpoint, they may be grouped into four classes: 1. Broom corn, grown primarily for the brush used in the manufacture of brooms; the crop is mainly produced in Oklahoma and adjacent states. 2. Grass sorghum; the most important one is Sudan grass, which is grown for forage for stock. 3. Sorgo, or the saccharine sorghums, many of which are used for the manufacture of sirup, being grown for this purpose in most of the Southern States. In recent years these varieties have proved to be extremely valuable as forage plants for stock. 4. The grain sorghums, varieties valuable primarily for their grain, as Durra, Feterita, Kafir, Milo, Kaoliang and Shallu. Kansas, Oklahoma and Texas are the leading states for their cultivation.

Smut Resistance of Sorghum Varieties

The most extensive data on the smut resistance of sorghums have been obtained with the covered kernel smut[9]. By far the larger number of varieties grown in the United States, including Broom corn, Sudan grass, Kafir, Durra, Sorgo, Shallu and most of the Kaoliangs, are susceptible to this disease. A few varieties, however, have stood out as resistant, the most conspicuous being Feterita, Milo, Darso and an occasional variety of some of the other groups. There is evidence, however, that specialized races of the covered kernel smut exist and, consequently, the problem of varietal susceptibility is associated with that of the existence of these specialized races.[13]

On account of the marked differences in the resistance and susceptibility of the varieties to known races of the smuts, it was thought that hybrids between certain ones would be favorable material for the study of the inheritance of resistance to smut. Accordingly, various crosses, such as Feterita ×

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Sumac Sorgo, Blackhull Kafir × Standard White Milo and Feterita × Dawn Kafir, have been obtained and the susceptibility of the plants of the second, third and, to some extent, the fourth generation of these hybrids has been tested.

The Flowers of Sorghum

Sorghums are not particularly easy plants to cross. The flower is small and the glumes are rather stiff. Further, when a successful cross is made, only one seed or grain results from the operation.

The inflorescence of the sorghum is a panicle. In some varieties, such as Feterita, Kafir, Durra and Kaoliang, it is relatively compact, while in others, such as Black Amber and Red Amber Sorgo, it is loose and spreading, a condition which reaches its maximum in Broom corn. The spikelets are arranged in pairs along the rachis. The basal spikelet of each pair is perfect, consisting of the two outer glumes enclosing the ovary with the two branched stigmas and the three stamens. The upper spikelet, borne on a short stalk, is sterile, or sometimes staminate.

The flowers at the apex of the panicle are the first to open and for a period of several days the flowers continue to develop towards the base. The stigmas of the flowers mature and push out first, followed later by the stamens. Probably the stigmas are generally pollinated by pollen from the flowers located higher up in the panicle. All sorghums seem to be entirely self-fertile, since heads, properly bagged, will regularly set an abundance of seed. In most cases, however, pollination takes place from different flowers on the same head and not from the same flower.

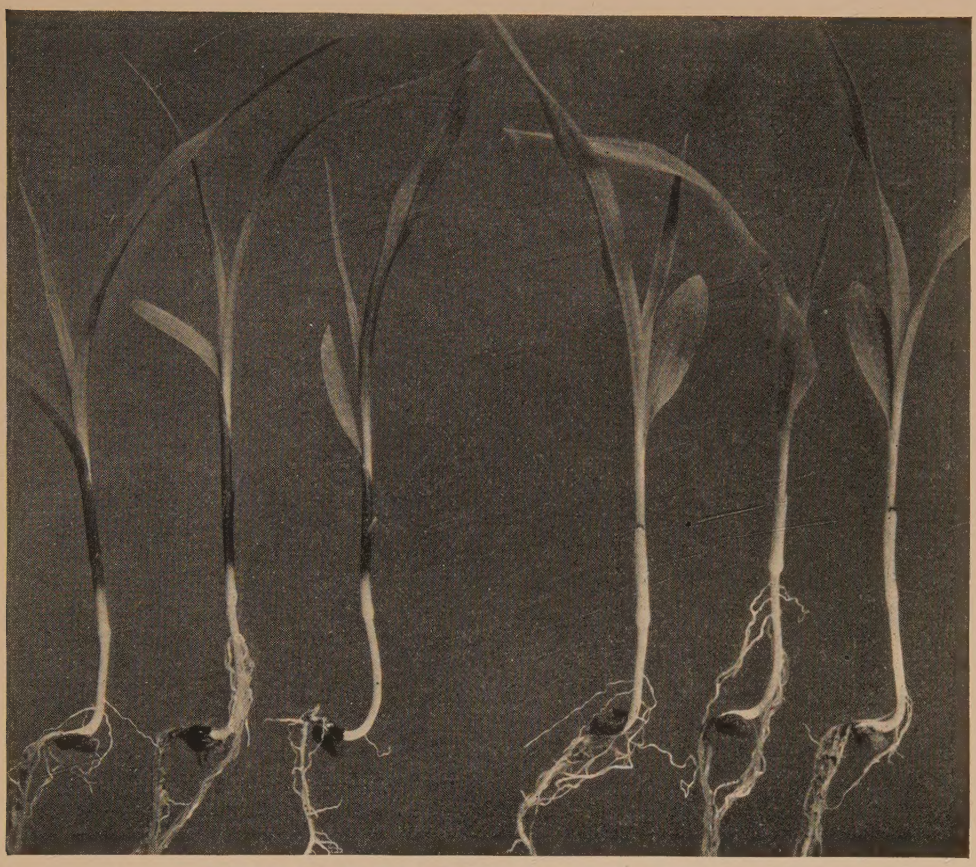
Natural Crossing of Sorghum Varieties

The sorghums seem adapted to wind pollination and doubtless the pollen may be carried from one variety to another by this agency. To some extent, however, the pollen may be carried by insects, since various beetles and bees visit the flowers in great numbers. Natural crossing between the varieties is known to occur when different varieties are grown adjacent to each other. Ball[1] states that as high as 50 per cent of the seed may be cross pollinated when varieties flowering at approximately the same dates are growing side by side. The direction of the prevailing wind influences the amount of cross pollination. Graham[3] observed cross pollination between various varieties. The highest percentage which he obtained was 20 per cent. Karper and Conner[4] recorded the amount of natural crossing between Standard Yellow and Standard White Milo, two varieties of about the same height and whose panicles develop at approximately the same time. Out of a total of 13,430 plants, 788 were evidently cross pollinated with the Yellow Milo pollen, a percentage of crossing of about 6 per cent. Sieglinger[11] made further studies on cross pollination between these two varieties, and obtained a percentage of crossing of 5.38, or 276 plants out of a total of 5,125.

Vinall and Cron [14] have been successful in making numerous crosses of sorghums by artificial hybridization, and Vinall[15] has described a method for making the crosses. Sorghum hybrids are favorable material for the study of the inheritance of various characters, and several workers, as Conner and Karper,[2] Graham,[3] Ramanathan,[5] Sieglinger[12] and Vinall and Cron[14] have described their results.

Color of Sorghum Seedlings

During the course of our experiments, the germination of the seedlings of most sorghum varieties was observed. It was noted that in some varieties, of which Dawn Kafir is a typical illustration, the young seedlings, after emergence from the soil, are pale yellow-green to green in color. When the seedlings are ten to fifteen days old, being at that time three to four inches tall with two to three leaves, the vivid green color is well defined in the leaves



RED AND GREEN SEEDLINGS OF SORGHUM

Figure 25

To the left are three red and to the right three green seedlings. The specimens actually photographed are F_2 plants of the cross Feterita × Red Amber Sorgo, and the contrast between the two types of seedlings is well shown.

and their sheaths. The first sheath or coleoptile, however, is pale yellowish green above the soil level, gradually shading to pale yellowish white below. Other varieties which produce green seedlings are Feterita, Shallu and Black Amber Sorgo. In Feterita we find a less brilliant green coloration than in some of the others, as the seedlings are often slightly flushed with a pinkish tone.

In contrast to these green seedlings of the Dawn Kafir are the seedlings of the Red Amber Sorgo. These, taken at the same age, have a very distinct red coloration of the emerged coleoptile and the sheath of the first leaf, the color even extending more or less into the base of the leaf blade. The part of the coleoptile below the soil is pale yellowish white and contrasts strikingly with the deep red color of the emerged portion. There is, therefore, a sharp contrast between the green seedlings of the Dawn Kafir and the red seedlings of the Red Amber Sorgo (Figures 24 and 25). Other red seedling types are Sumac Sorgo, Durra, Milo and several varieties of Kaoliang.

A second observation in our seedling germinations was the fact that the F_2 seedlings, grown from the seed of the F_1 plant of the hybrid Feterita × Sumac Sorgo were of two kinds—red

HYBRID VIGOR OF SORGHUMS
Figure 26

To the left are four plants of Dawn Kafir, a green seedling type, and to the right four hybrid plants grown from red seedlings taken from the same seed pan. The seed of all eight plants came from the same head of Dawn Kafir which had been pollinated with pollen from Standard Yellow Milo. The hybrid plants varied from 9 to 9½ feet in height. Yellow Milo plants grow from 6½ to 7½ feet in height.

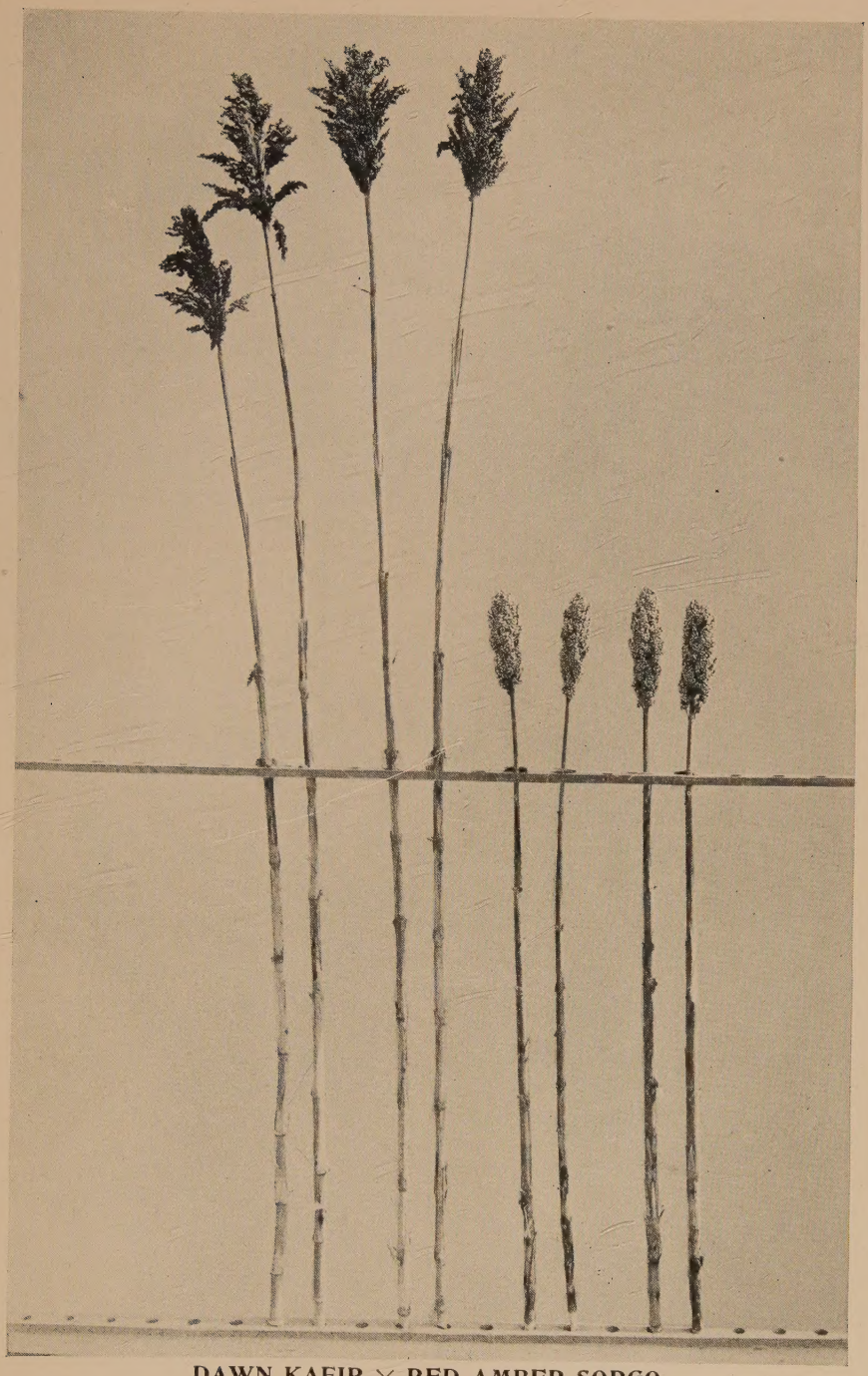
seedlings and green seedlings. Usually these could be readily distinguished from each other, the red seedlings greatly predominating. Several preliminary counts indicated a ratio more or less approaching three red seedlings to one green, with the red color dominant.

These two observations suggested a simple way of obtaining and detecting hybrids between certain desired sorghum varieties.

Method of Cross-Pollinating the Varieties

The method of procedure was to select two varieties which differ in their seedling color, such as Dawn Kafir and Red Amber Sorgo. The heads of both plants, as soon as they began to emerge and before any flowers had opened, were carefully bagged. As soon as open flowers appeared, the pollen collected on the Red Amber Sorgo, the red seedling parent, was shaken over the head of the Dawn Kafir. Both heads were re-bagged and this operation of dusting on the pollen was repeated at two-day intervals several times, or as long as flowers continued to open on the green seedling parent.

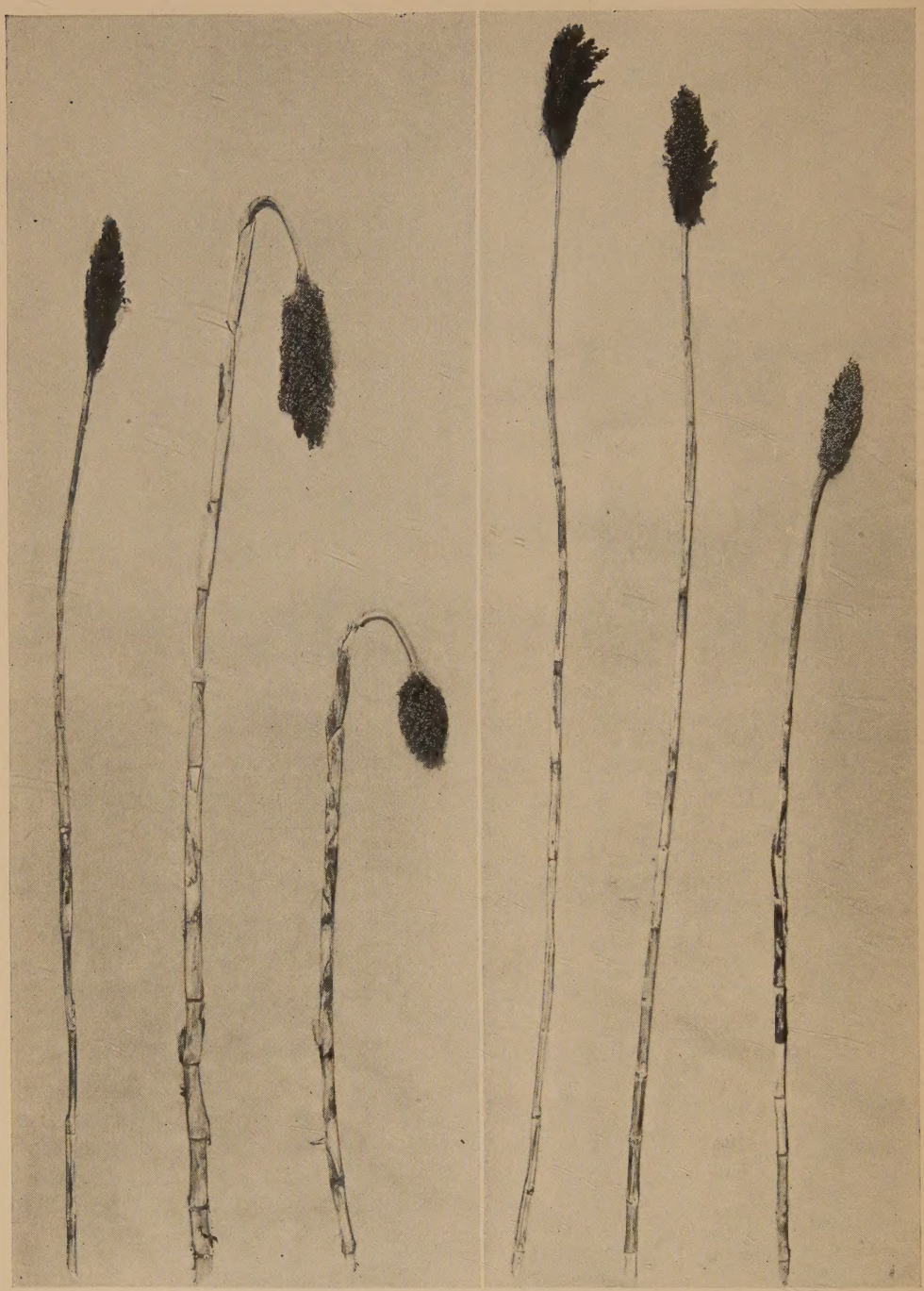
The procedure was based on the assumption that the foreign pollen would reach the stigmas of at least a few of the flowers at the right time in a viable condition and bring about cross pollination. It was expected that most of the flowers would be selfed, due to the relative abundance of pollen from other flowers on the same head. It was also probable that this pollen would be more viable and also reach the stigmas at the proper time as compared with that introduced from the other plant.



DAWN KAFIR × RED AMBER SORGO

Figure 27

To the left are two plants of Red Amber Sorgo and to the right two of Dawn Kafir. The seed of the four middle plants was taken from the same head of Dawn Kafir, which had been pollinated with pollen of Red Amber Sorgo. Plants 3 and 4 from the left came from red seedlings, while plants 5 and 6 came from green seedlings. Evidently plants 3 and 4 are true hybrids, while 5 and 6 resemble exactly the Dawn Kafir parent. Hybrid vigor is shown by the slightly increased height and also by the larger, more productive heads.



HYBRID VIGOR AND INTERMEDIATE INHERITANCE

Figure 28

Black Amber Sorgo × *Dwarf Yellow Milo.* A single plant of the Black Amber Sorgo is shown on the left, one of Dwarf Yellow Milo on the right, and the F_1 plant in the middle. The latter shows exceptional hybrid vigor.

Figure 29

Feterita × *Manchu Kaoliang.* The Manchu Kaoliang is shown on the left, the F_1 plant in the middle, and the Feterita on the right. So far as height is concerned, the hybrid plant is intermediate between the two parents.

Method of Detecting the Occurrence of the Hybrids

The head of the Dawn Kafir or other green seedling parent used was permitted to mature. The seed was then collected and later germinated in sand under favorable temperature and moisture conditions. If the method of producing hybrids was successful, it was expected that two types of seedlings from the same head would be obtained, most of them coming from selfed flowers being green, the characteristic color of the mother plant, and others red, due to the foreign pollen, and hence hybrids. The red seedlings were, of course, the young F_1 plants and were recognized by their dominant red color.

Preliminary Experimental Data

In the fall of 1926 a head of Feterita, a green seedling type, was pollinated in the above manner with pollen from Standard White Milo, a red seedling variety. In the same way, a head of Blackhull Kafir was pollinated with Red Amber Sorgo pollen, and another head with pollen from Valley Kaoliang. The following spring the seed from these three heads was greminated. From the Feterita 257 seedlings were secured and 11 of these (4.2 per cent) were red in color. These seedlings were transplanted to the field and grown to maturity and they all proved to be hybrid plants. For purposes of comparison, ten of the green seedlings from the same seed pan were also grown to maturity and these proved to be typical of the female parent—Feterita.

From the head of Blackhull Kafir pollinated with pollen from Red Amber Sorgo, 1097 seedlings were germinated and four (0.36 per cent) were red, and from the head of Blackhull Kafir, cross-pollinated with Valley Kaoliang, a total of 694 seedlings were grown, of which 23 (3.3 per cent) were red in color. In both these cases the red seedlings were grown to maturity and in every case proved to be hybrids. Along with each set ten green seedlings from the same germinating pans were also grown, and these proved to be identical with the Blackhull Kafir or female parental variety.

These preliminary results indicated the effectiveness of the method of procedure. It is evident that if foreign pollen is introduced onto a head in the blossoming stage, at least some of the flowers will be cross pollinated, and the detection of the hybrids may be made at the time when the seed is germinated. Only those seedlings which appear to be hybrids need be grown to maturity and in this way the relatively large numbers of seedlings from self pollinated flowers may be discarded and the space and labor spent upon growing them saved. Further, the effort involved in the cross pollination is relatively little as compared with the tedious hand method of procedure which involves the emasculation of individual flowers and the later application of the desired pollen.

Later Experiments

The results from the first year were so highly successful that essentially the same method was employed to secure additional hybrids between a large number of different sorghum varieties. During August and September 1927 the pollinations were carried out. The green seedling varieties used as the female included Darso, Feterita, Dawn Kafir, Sunrise Kafir and Dakota Amber Sorgo. Among the red seedling parents were Brown Durra, Barchet Kaoliang, Manchu Kaoliang, Red Amber Sorgo, Red Jowar and three varieties of Milo—Standard Yellow, Standard White and Dwarf Yellow.

The ripe heads were collected and early in the spring of 1928 the seed from these was germinated and the number of green and red seedlings observed. In practically every case both types of seedlings were secured although, as in the previous year, the number of green seedlings greatly predominated. The percentage of red seedlings varied from less than one per cent to as high as 18.3 per cent. The highest percentage was obtained when Dawn Kafir was used as the green

seedling parent. This variety with Red Amber Sorgo gave 18.3 per cent, with Dwarf Yellow Milo 16.6 per cent, and with Standard Yellow Milo 10.0 per cent red seedlings.

Most of the red seedlings obtained in these germination tests were transplanted to the field and grown to maturity. Along with them seed of both parents, as well as green seedlings from each seed pan were planted. Accordingly, there was a direct opportunity for observing the characteristics of plants from seed from the same identical head, arising from green and red seedlings respectively, growing alongside the original male and female varieties.

A total of 169 red seedlings from all crosses were obtained and of these 147 were grown to maturity. All except two proved to be hybrids. In 1929 an additional quantity of seed of a few of these hybrids was grown. In this year, 42 red seedlings from five of the different crosses were obtained. These were grown to maturity and all of them turned out to be hybrids. In each case ten green seedlings were also grown to maturity, and two of these turned out to be hybrids, not having been detected in the seed pan. These results certainly indicate a high degree of effectiveness in the method of producing and detecting the hybrids.

In 1928 a somewhat different procedure was tried out. Heads of Feterita and of Red Amber Sorgo were secured under the same bag and the plants were casually shaken at intervals during the subsequent days. The Feterita head was saved, the seed germinated and the young plants examined for red seedlings. This modification of the procedure was effective, for out of a total of 681 seedlings germinated, 56 (8.2 per cent) were red and when grown to maturity proved to be true hybrids.

The question may be raised as to why there was not a much larger number of successful cross pollinations. Perhaps the environal conditions furnish part of the explanation, since in general they were unfavorable. Each year the period during which the work was carried out was characterized by a great deal of rainy, humid weather. There was also the problem of applying the pollen at the proper time, when the stigmas were in a receptive condition, and no special studies were made as to its viability.

There are, of course, very obvious limitations of the method. In every case the female parent must be a green seedling type, since the red seedling color is the dominant character. If the pollination is carried out in the reciprocal manner, it would be impossible to distinguish between the true breeding red seedlings of the female parent and those that might be hybrids. Accordingly, reciprocal crosses are not possible by the method. However, the ease of obtaining a large number of desired crosses is so obvious that it has distinct advantages, and the reciprocal crosses may be secured by the more tedious single-flower method. The method of securing F_1 plants and their subsequent detection is effective. Only rarely is a hybrid plant overlooked or a mistake made in picking out a green type. It is evident the method is a very successful one for the purposes intended.

Hybrid Vigor of the F_1 Plants

One of the striking features of some of the F_1 plants was their remarkable vigor as compared with the parental varieties (Figures 26, 27, 28). This was especially evident in crosses involving Dawn Kafir and Dwarf Yellow Milo. The F_1 plants grown averaged 7½ to 8 feet in height, while the Dawn Kafir plants were 3½ to 4½ feet and the Dwarf Yellow Milo 4 to 4½ feet; thus the F_1 plants had a height nearly equal to the combined height of the two parents. Dawn Kafir × Standard Yellow Milo also gave striking evidence of hybrid vigor. In this case, the F_1 plants varied from 9 to 9½ feet, Dawn Kafir from 3½ to 4½, and the Standard Yellow Milo from 6½ to 7½ feet. Black Amber Sorgo × Standard Yellow Milo and also Black Amber Sorgo × Standard White Milo showed distinct evidence of increased hybrid

vigor, the hybrid plants being 8 to 9½ feet in height, while the Black Amber Sorgo was 6 to 6½ and the Milo parents 7 to 7½ feet. The height of the F_1 plants of Feterita × Durra, Feterita × Red Amber Sorgo, and Dawn Kafir × Red Amber Sorgo, was about equal to that of the taller male parent. In the cross between Feterita and Manchu Kaoliang, the F_1 plant was somewhat intermediate in height between the two parents (Figure 29).

Not only was there a marked increase in the height of the stalk of some of the F_1 plants as compared with their parents, but the panicle or head was greatly enlarged. This resulted in an unusual increase in the number of seeds which were produced (Figures 27, 28, 30).

Accompanying this hybrid vigor was increased stooling and lateness of maturing. In most cases, the F_1 plant matured slightly later than the late maturing parent. In the crosses involving the varieties of Milo as one of the parents, there was a very marked delay in the maturing of the hybrid; in fact, it was so much so that good ripe seed in none of these crosses was obtainable, although the more or less immature seed gave a high percentage of germination.

Inheritance of Seedling Color

Since the red color is dominant in the seedlings, it is interesting to know how it will be distributed among the F_2 population. Accordingly, large quantities of seed from different F_1 plants have been germinated in order to determine the occurrence and distribution of the two types of seedlings. The most extensive series was carried out during August and September 1929, when conditions appeared particularly favorable in the greenhouse. The days were bright, the temperature quite high, and the seedlings grew rapidly. The data could be obtained in about nine days, and the differences showed up clearly for at least a week longer (Figure 24).

Table I shows the number of F_1 plants of the different crosses, the total number of seedlings grown, the number of red seedlings, the number of green seedlings, and the percentage of the latter. In most cases the two types of seedlings could be readily distinguished. There were variations in the intensity of the red color, but ordinarily there was enough difference to permit a proper classification.

The lowest percentage of green seedlings obtained was 21.2 per cent with the cross Feterita × Red Amber Sorgo. In this case there was a total of 377 plants, of which 297 were red and 80 were green. The highest percentage of green seedlings recorded in the table was 36.3 per cent, in the hybrid Black Amber Sorgo × Dwarf Yellow Milo; 99 seedlings were grown, of which 63 were red and 36 were green.

The combined data of the 31 crosses, involving 12 combinations of varieties, gave 3743 total seedlings, of which 2683 were red and 1060 green, the percentage of the latter being 28.3. It is evident from the germination tests of all these hybrids that segregation in the second generation occurs approximately in the ratio of three red seedlings to one green seedling.

Value For Class Purposes

This particular material has proved of special value for the purpose of teaching students simple segregation of a character in the second hybrid generation. It is extremely interesting to watch the germination of the young seedlings and the gradual differentiation into red and green. The period during which they may be observed to advantage varies from one to three weeks. In most cases there is no difficulty in distinguishing the red seedling type from the green. There is further the advantage in the fact that the seedlings are very easily grown under ordinary laboratory conditions.

Inheritance of Smut Resistance

Extensive data have already been obtained on the inheritance of the smut-resistant quality in sorghum hybrids.[6, 7] In this study, however, several difficul-

DAWN KAFIR × STANDARD YELLOW MILO

Figure 30

On the left a head of Dawn Kafir, on the right a head of Standard Yellow Milo, and in the middle the greatly enlarged and productive head of the F_1 plant.

ties have been encountered. Successful infection of sorghums by the covered kernel smut is greatly influenced by environal conditions such as soil temperature, soil moisture and soil acidity.[8] It is extremely difficult to obtain the most favorable combination of these factors in order to secure the maximum number of infected susceptible plants.

Some of our data are recorded in the accompanying Table II. With the cross Feterita × Sumac Sorgo, F_2 plants inoculated with covered kernel smut were grown during each of the six years 1924 to 1929, along with the two parental varieties. The infection of the susceptible parent, Sumac Sorgo, varied from 38.3 per cent in 1924 to 86.1 per cent in 1926. The average for the six years was 50.9 per cent, 601 plants being inoculated. Feterita, during the same period, gave only one infected plant out of a total of 515.

The F_2 plants of the Hybrid 1-A gave percentages of infection varying from 23.5 per cent in 1928 to 69.6 in 1926. During the six years a total of 954 plants have been grown, of which 446 (46.7 per cent) were infected. With the second hybrid 1-B, the highest percentage of infection was 67.1 per cent in 1926, and the lowest 33.8 per cent in 1928; out of a total of 926 plants grown, 380 (41.0 per cent) were infected. It is especially interesting to note that high percentages of infection of the F_2 generation of the hybrid were obtained in those years when the Sumac Sorgo gave the greatest number of smutted plants.

While by no means conclusive, the results suggest that susceptibility is dominant, and if it were possible to secure approximately 100 per cent in-

fection of the susceptible Sumac Sorgo, we might expect that the second generation of the hybrid would give approximately three smutted plants to one normal.

The results with another hybrid between Blackhull Kafir and Standard White Milo are also interesting. Inoculated F_2 plants were grown from 1924 to 1927, and these gave infections varying from 6.2 to 17.1 per cent. During the four years, 620 plants were grown, of which 64 (10.3 per cent) were infected. During the same period the susceptible parent, Blackhull Kafir, gave 56.5 per cent infection or 216 plants out of a total of 382. Standard White Milo, on the other hand, gave completely negative results all four years, a total of 373 inoculated plants being grown.

The results with this hybrid suggest a very different situation as compared with the previous one. In this particular cross, the results obtained indicate that resistance is dominant and that, under the most favorable conditions, not more than one-fourth of the F_2 plants would be smutted.

Several of the descendants of the F_2 plants of these hybrids have been carried through to the third and fourth generations, and smut resistance has shown various combinations with the other characters of the two parental varieties. Completely resistant lines, resembling the susceptible parent in many characters, have been separated out. Thus it seems entirely possible to produce new types with any desired combination of morphological or agronomic characters, together with a high degree of resistance to smut.

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	No. of crosses	Seedlings			
		Total No. F_2	No. Red	No. Green	Per cent Green
Feterita × Sumac Sorgo	2	194	151	43	22.1
Blackhull Kafir × Red Amber Sorgo	1	90	67	23	25.5
Blackhull Kafir × Valley Kaoliang	1	96	63	33	34.3
Feterita × Brown Durra	5	621	429	192	30.9
Feterita × Manchu Kaoliang	3	568	434	134	23.5
Feterita × Red Amber Sorgo	1	377	297	80	21.2
Dawn Kafir × Dwarf Yellow Milo	4	372	240	132	35.4
Dawn Kafir × Standard Yellow Milo	4	360	240	120	33.3
Dawn Kafir × Red Amber Sorgo	5	573	429	144	25.1
Black Amber Sorgo × Dwarf Yellow Milo	1	99	63	36	36.3
Black Amber Sorgo × Standard Yellow Milo	1	99	67	32	32.3
Black Amber Sorgo × Standard White Milo	3	294	203	91	30.9
	31	3743	2683	1060	28.3

TABLE I—Inheritance of Seedling Color in Sorghum Hybrids.

TABLE II (at right) Results with the F_2 Generation of Sorghum Hybrids inoculated with Sphacelotheca sorghi—1924—1929.

Hybrids and Parental Var.	Year	No. Plants	No. Inf.	Percent Inf.
Feterita × Sumac Sorgo (Hybrid No. 1-A)	1924	306	121	39.2
	1925	144	63	43.7
	1926	165	115	69.6
	1927	135	66	46.1
	1928	89	21	23.5
	1929	113	61	53.9
		954	446	46.7
Feterita × Sumac Sorgo (Hybrid No. 1-B)	1924	307	112	36.4
	1925	145	53	36.5
	1926	140	94	67.1
	1927	153	53	34.6
	1928	68	23	33.8
	1929	113	45	39.8
		926	380	41.0
Sumac Sorgo	1924	271	104	38.3
	1925	72	29	40.2
	1926	101	67	66.3
	1927	67	33	49.2
	1928	39	15	38.4
	1929	51	38	74.5
		601	306	50.9
Feterita	1924	272	0	0
	1925	67	0	0
	1926	44	0	0
	1927	65	0	0
	1928	21	1	4.7
	1929	46	0	0
		516	1	0.1
Standard White Milo × Blackhull Kafir	1924	198	14	6.9
	1925	130	14	10.7
	1926	163	28	17.1
	1927	129	8	6.2
		620	64	10.3
Blackhull Kafir	1924	148	89	60.0
	1925	61	44	72.1
	1926	111	53	47.7
	1927	62	30	46.3
		382	216	56.5
Standard White Milo	1924	223	0	0
	1925	72	0	0
	1926	58	0	0
	1927	20	0	0
		373	0	0

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